ECON 002 - Principles of Microeconomics
Drake University, Fall 2025
William M. Boal

Signature: _____

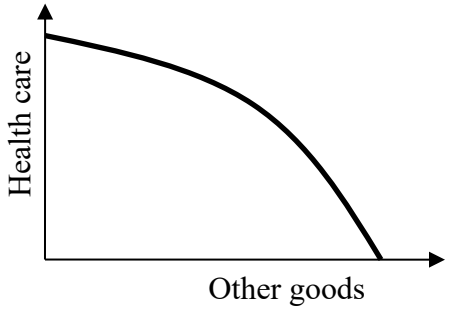
Printed name: _____

FINAL EXAMINATION VERSION A
December 8, 2025

INSTRUCTIONS: This exam is closed-book, closed-notes. Simple calculators are permitted, but graphing calculators, calculators with alphabetical keyboards, cell phones, and wireless devices are NOT permitted. Numerical answers, if rounded, must be correct to at least 3 significant digits. Point values for each question are noted in brackets. Maximum total points are 200.

I. Multiple choice: Please circle the one best answer to each question. [1 pt each, 25 pts total]

(1) Suppose a country's production possibility curve is as shown below. By definition, what is held constant along the curve?
a. Output of health care.
b. Output of other goods.
c. The country's total inputs.
d. The prices of health care and other goods.
e. None of the above.

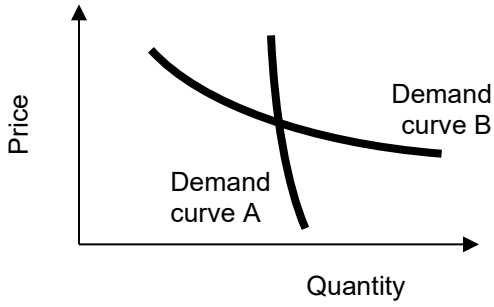


(2) The Law of One Price means
a. efficient markets eliminate price dispersion.
b. the total quantity buyers want to buy is negatively related to the price.
c. a good cannot be resold.
d. all sellers are required by law to quote the same price.
e. the buyer and the seller in each transaction must agree on a price.

(3) A rise in the price of ice cream will shift the demand for frozen yogurt to the right, assuming ice cream and frozen yogurt are
a. complementary goods.
b. substitute goods.
c. normal goods.
d. inferior goods.

(4) Data show that the average price of new houses is rising but the quantity of new houses being built is falling. This could be caused by a
a. rightward shift in the demand for new houses.
b. rightward shift in the supply of new houses.
c. leftward shift in the demand for new houses.
d. leftward shift in the supply of new houses.

(5) Which demand curve below is *more* elastic?
a. Demand curve A.
b. Demand curve B.
c. Both have the same elasticity because they pass through the same point.
d. Cannot be determined from information given.



The next three questions refer to the following demand and supply schedules for corn in two countries.

	Country X		Country Y	
Price	Q_D	Q_S	Q_D	Q_S
\$1	60	30	60	0
\$2	50	50	50	5
\$3	40	70	40	10
\$4	30	90	30	15
\$5	20	110	20	20
\$6	10	130	10	25
\$7	0	150	0	30

(6) In the absence of international trade, Country X's equilibrium price of corn would be
a. \$2.
b. \$3.
c. \$4.
d. \$5.
e. \$6.

(7) With international trade, the equilibrium price of corn in both countries would be
a. \$2.
b. \$3.
c. \$4.
d. \$5.
e. \$6.

(8) Who in Country X benefits from international trade in corn?
a. Buyers in Country X.
b. Sellers in Country X.
c. Both buyers and sellers in Country X.
d. Neither buyers nor sellers in Country X.

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(9) A change in the number of people who buy cigarettes is called a change at the
a. extensive margin.
b. intensive margin.
c. marginal product.
d. marginal revenue.

(10) The slope of a firm's total revenue curve by definition equals the firm's
a. total revenue.
b. average revenue.
c. marginal revenue.
d. total cost.
e. average cost.
f. marginal cost.

(11) The increase in cost caused by the last unit of a firm's output is called the firm's
a. marginal cost.
b. marginal revenue.
c. average cost.
d. unit cost.

(12) In the *short run*, a firm should continue operating if its revenue is sufficient to pay at least its
a. fixed cost.
b. variable cost.
c. total cost.
d. accounting cost.

(13) A perfectly competitive firm expects that if it decreases its output, the price will
a. increase.
b. stay the same.
c. decrease.
d. cannot be determined from information given.

(14) A monopolist always sets price
a. equal to marginal cost.
b. above marginal cost.
c. below marginal cost.
d. cannot be determined from the information given.

(15) Which market model predicts the highest equilibrium quantity of output?
a. Perfect competition.
b. Monopoly.
c. Cournot oligopoly.
d. All models predict the same equilibrium price, if all use the same assumptions about market demand and marginal cost.

(16) Entry into the ethnic restaurant business is practically free, but each restaurant's cuisine is somewhat different from others'. Therefore, a sensible economic model for ethnic restaurants is
a. monopoly.
b. joint-profit-maximizing cartel.
c. monopolistic competition.
d. perfect competition.

(17) The Des Moines Art Museum is spacious enough that it can accommodate many visitors without crowding. However, it *can* charge admission—and sometimes does so for special events. The Museum is thus
a. a nonrival good.
b. a nonexcludable good.
c. both of the above.
d. none of the above.

(18) Water aquifers (underground water sources) in the western United States are rapidly being depleted. No one can be prevented from taking water from a well on their own property—yet the more water is taken, the less is left for other people. Water aquifers in the western United States are therefore
a. a nonrival good.
b. a nonexcludable good.
c. both of the above.
d. none of the above.

(19) If you gaze at the moon, other people can do so at the same time, and no one can make you pay for it. A view of the moon is therefore
a. a nonrival good.
b. a nonexcludable good.
c. both of the above.
d. none of the above.

(20) The electric company monitors each customer's usage and bills for it. If a customer does not pay, the customer's electric power is turned off. Now electric power that flows to one customer cannot flow to another customer. Electric power is therefore
a. a nonrival good.
b. a nonexcludable good.
c. both of the above.
d. none of the above.

(21) I enjoy viewing my neighbors' flowers, even though I do not pay for them. My neighbor's flowers therefore create
a. an external benefit.
b. an external cost.
c. a common property resource.
d. a private good.

(22) Electric power plants that burn coal can put sulfur dioxide in the atmosphere. This chemical returns to earth as "acid rain," killing fish and ruining the fishing downwind of the plants. Burning coal therefore creates
a. an external benefit.
b. an external cost.
c. a budget constraint.
d. an inferior good.

(23) If a good creates an external benefit then the resulting market failure can in theory be corrected
a. with a tax.
b. with a subsidy.
c. by completely banning the product.
d. any of the above.

(24) Economists believe that environmental problems are caused, for the most part, by
a. misaligned incentives.
b. market power.
c. lack of awareness.
d. moral failing.

(25) Unlike other taxes, a pollution tax
a. generates no revenue for the government.
b. affects only producers.
c. causes deadweight loss.
d. increases economic efficiency.

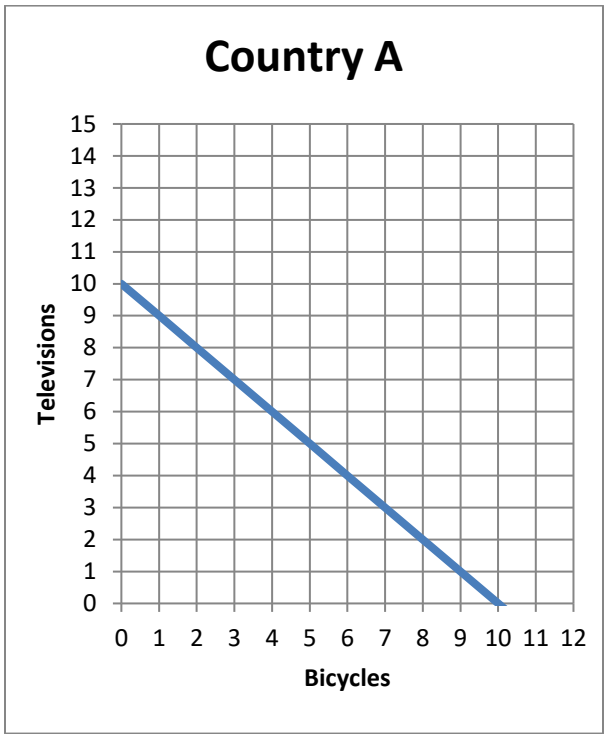
II. Problems: Insert your answer to each question in the box provided. Use margins and graphs for scratch work. Only the answers in the boxes will be graded. Work carefully—partial credit is not normally given for questions in this section.

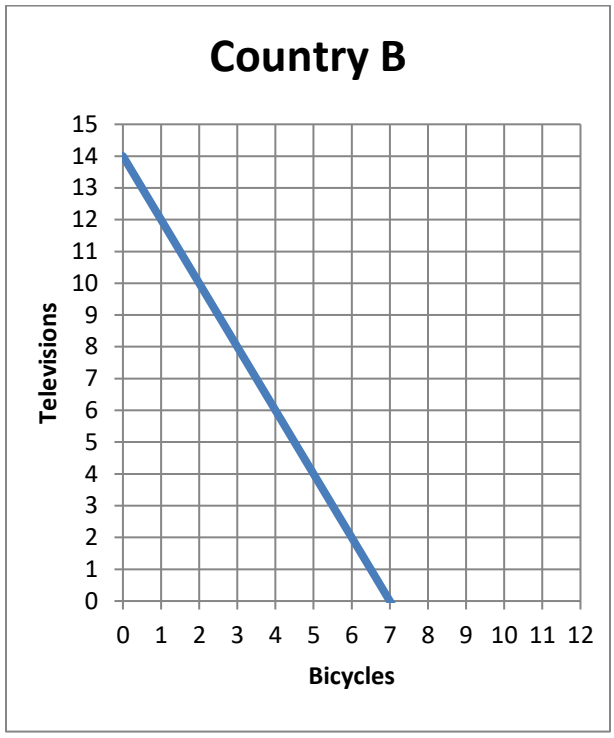
(1) [Production functions: 7 pts] A work crew reroofs houses. Complete the table by computing the work crew's average product and marginal product and placing your answers in the unshaded cells of the third and fourth columns below. Then answer the question below.

Number of workers	*Houses reroofed per month*	*Average Product*	*Marginal Product*
0 workers	0 houses		
			houses per worker
3 workers	6 houses	houses per worker	
			houses per worker
6 workers	18 houses	houses per worker	
			houses per worker
9 workers	36 houses	houses per worker	

Is the work crew's production function characterized by *diminishing returns* to their labor input? Answer YES or NO.

(2) [Comparative advantage, gains from trade: 17 pts] Country A and Country B can each produce televisions and bicycles. They each face a tradeoff between these two products because of limited workforces. Their production possibility curves are shown below.





a. What is Country A's opportunity cost of producing a television? bicycles

b. What is Country B's opportunity cost of producing a television? bicycles

c. What is Country A's opportunity cost of producing a bicycle? televisions

d. What is Country B's opportunity cost of producing a bicycle? televisions

e. Which country has a comparative advantage in producing televisions?

f. Which country has a comparative advantage in producing bicycles?

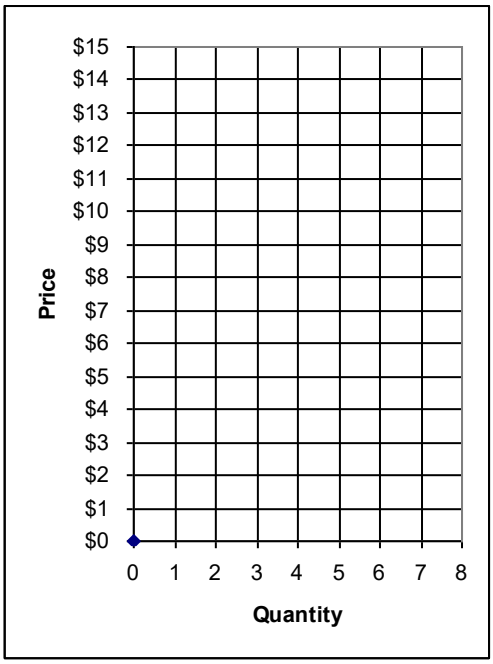
g. [3 pts] Fill in the blanks: *Both* countries can consume combinations of products *outside* their individual production possibility curves if _____ exports *three* bicycles to _____, which exports _____ televisions in return.

h. **Plot** the trade that you propose in part (g) on the graphs above. For each country, plot and label the starting point representing **production before trade**, and the ending point representing **consumption after trade**.

(3) [Market equilibrium: 12 pts] Suppose seven buyers and seven sellers engage in a market similar to the exercise we did in class. Each buyer may buy at most one unit and each seller may sell at most one unit, but no one is forced to trade. Assume that buyers and sellers are each trying to maximize their own surplus (or "gains from trade"). Surplus for each buyer equals the buyer's value of the good minus the price paid. Surplus for each seller equals the price received minus the seller's cost of the good. Surplus of persons who do not trade are zero. Buyers' values and sellers' costs are given in the following table.

Buyer	*Value*
Bob	\$14
Barb	\$14
Ben	\$13
Bailey	\$12
Brian	\$11
Betty	\$ 9
Bert	\$ 7

Seller	*Cost*
Sue	\$ 1
Steve	\$ 2
Sam	\$ 3
Sven	\$ 4
Sarina	\$ 9
Sean	\$11
Sally	\$13



Suppose with some experience, the market settles on a single price. All trades are made at that price. (Hint: use the graph at right for scratch work.)

a. If the price were **\$5**, would there by *excess demand, excess supply*, or *neither*?

Now consider the market equilibrium.

b. What is the equilibrium price? Give an answer to the nearest whole dollar. \$

c. How many units of the good will be sold in this market? units

d. Compute the total revenue received by sellers (which equals the total spending by buyers). \$

e. Compute the combined total surplus (or gains from trade) of all buyers and sellers. (Check your answer carefully! No partial credit for being "close"!) \$

f. Who enjoys higher surplus in this particular market, the *buyers* or the *sellers?* Or is buyers' total surplus *equal* to sellers' total surplus?

(4) [Income elasticity of demand. 8 pts] According to the 2022 Consumer Expenditure Survey, the following are budget shares for low-income and high-income households. For each good, indicate whether it is a necessary good or a luxury good (sometimes called a "superior good"). Also indicate whether the income elasticity of demand is greater or less than one.

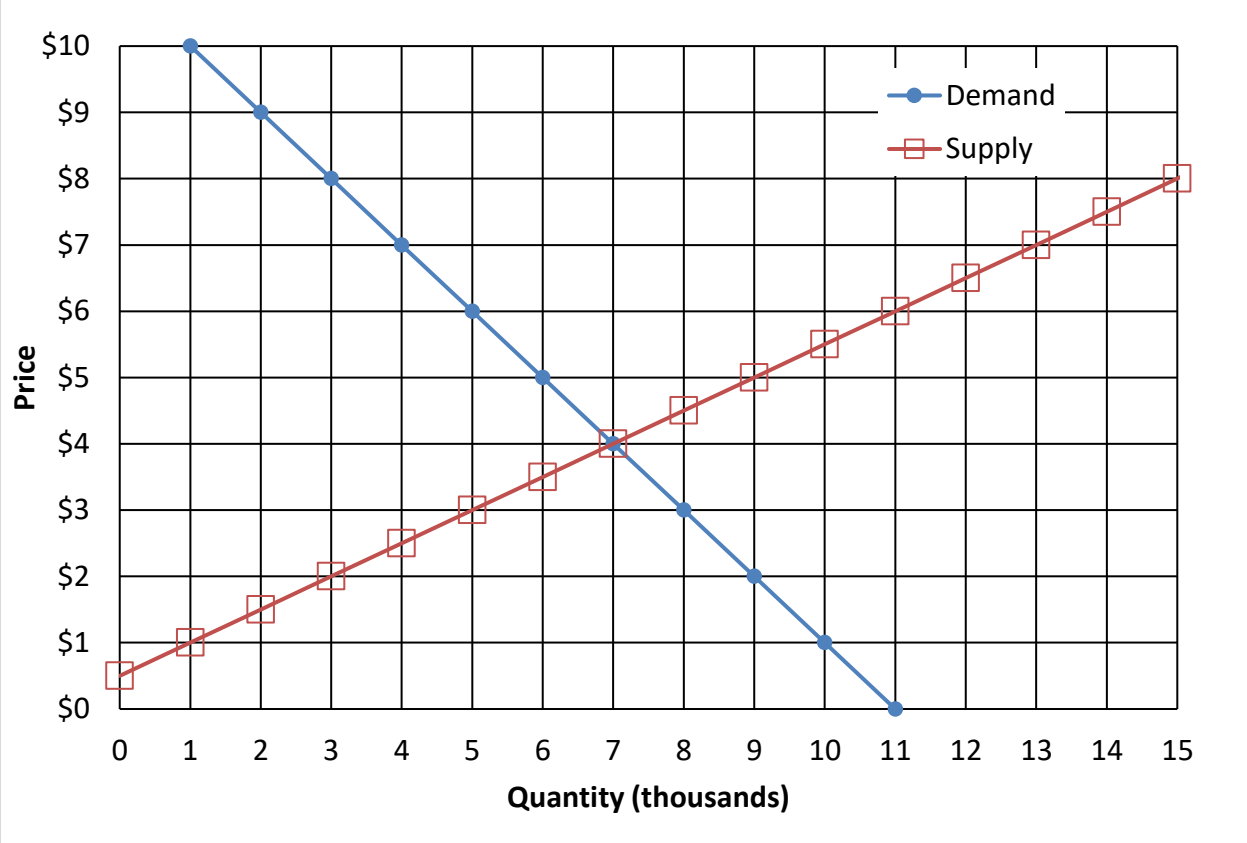
Good	Budget share, low income	Budget share, high income	*Necessary good* or *luxury good?*	Income elasticity of demand *greater than one* or *less than one?*
a. Entertainment	4.1%	5.3%		
b. Electricity	3.2%	1.6%		

(5) [Using price elasticity of demand: 10 pts] Suppose the electric power company *raises* rates by **5%**. Suppose the price elasticity of demand for electricity is **-0.6**. Assume everything else affecting demand for electricity remains constant.

a. According to the information above, is demand for electricity *elastic, inelastic,* or *unitary-elastic*?
b. As the price rises, will the quantity of electricity demanded *increase*, *decrease*, or remain *constant*?
c. ... by approximately how much?
d. Will the total revenue received by the electric power company *increase*, *decrease*, or remain *constant*?
e. ... by approximately how much?

%
%

(6) [Welfare analysis of tax or subsidy: 18 pts] The graph below shows the market for pumpkins.



Suppose the government pays a **subsidy of $ 3** per pumpkin.

a. Compute the equilibrium quantity sold.	thousand
b. Compute the equilibrium total price received by sellers (including the subsidy).	$ per pumpkin
c. Compute the equilibrium net price paid by buyers (excluding the subsidy).	$ per pumpkin
d. Does producer surplus *increase, decrease,* or *remain constant* because of the subsidy?	
e. By how much?	$ thousand
f. Does consumer surplus *increase, decrease,* or *remain constant* because of the subsidy?	
g. By how much?	$ thousand
h. Compute the direct cost of the subsidy to the government—that is, the amount that the government will have to pay buyers and/or sellers.	$ thousand
i. Compute the deadweight social loss caused by the subsidy.	$ thousand

(7) [Consumer choice and demand: 14 pts] The indifference curves in the graph below represent Jackson's preferences for pizza and milkshakes.

a. Would Jackson rather have 9 pizza slices and 3 milkshakes, or 6 pizza slices and 6 milkshakes?

	pizza slices and	milkshakes

b. Would Jackson rather have 4 pizza slices and 5 milkshakes, or 2 pizza slices and 12 milkshakes?

	pizza slices and	milkshakes

Suppose Jackson has a budget of \$60 to spend on pizza and milkshakes. The price of milkshakes is \$4.

c. **Using a straightedge**, carefully draw Jackson's budget line when the price of pizza slices is \$6. Label this budget line "A".

d. How many pizza slices will Jackson buy if the price of pizza slices is \$6?

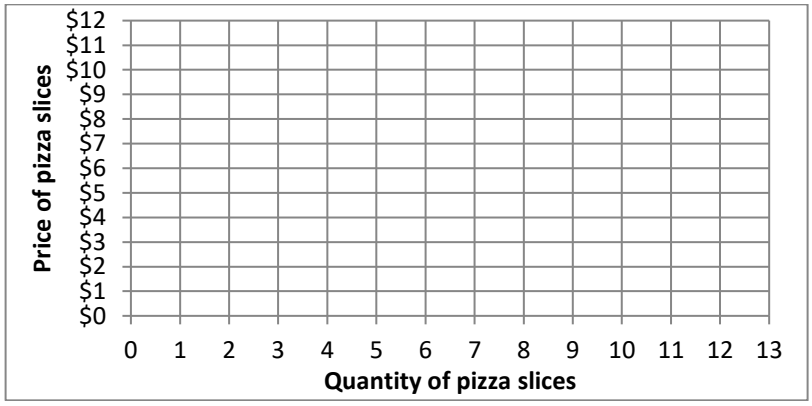
	pizza slices

e. **Using a straightedge**, carefully draw Jackson's budget line when the price of pizza slices is \$10. Label this budget line "B".

f. How many pizza slices will Jackson buy if the price of pizza slices is \$10?

	pizza slices

g. Plot two points on Jackson's demand curve for pizza, and sketch Jackson's demand curve at right.



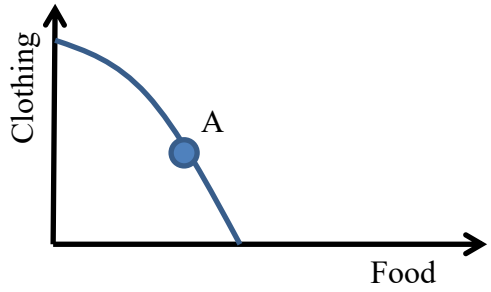
(8) [Rational choice: 10 pts] Ellwood City is installing traffic signals. The city manager has obtained cost estimates (there is some discount for volume purchases) and computed benefit estimates (where high-priority locations would be served first). The following are total cost and total benefit estimates.

Traffic signals	Total cost	Total benefit	Marginal cost per signal	Marginal benefit per signal
0	$ 0	$0		
			$ thousand	$ thousand
5	$15 thousand	$20 thousand		
			$ thousand	$ thousand
10	$25 thousand	$40 thousand		
			$ thousand	$ thousand
15	$30 thousand	$50 thousand		
			$ thousand	$ thousand
20	$35 thousand	$52 thousand		

a. [4 pts] Compute the marginal cost schedule. Insert your answers above.
b. [4 pts] Compute the marginal benefit schedule. Insert your answers above.
c. [2 pts] How many traffic signals should Ellwood City install? (Answer must be 0, 5, 10, 15, or 20).

signals

(9) [Economy-wide efficiency: 16 pts] The graph below shows a country's production possibilities curve. The country is currently at point A, where the slope equals **-2**.



Production possibilities curve

a. What is this **country's** opportunity cost of a unit of food? units of clothing

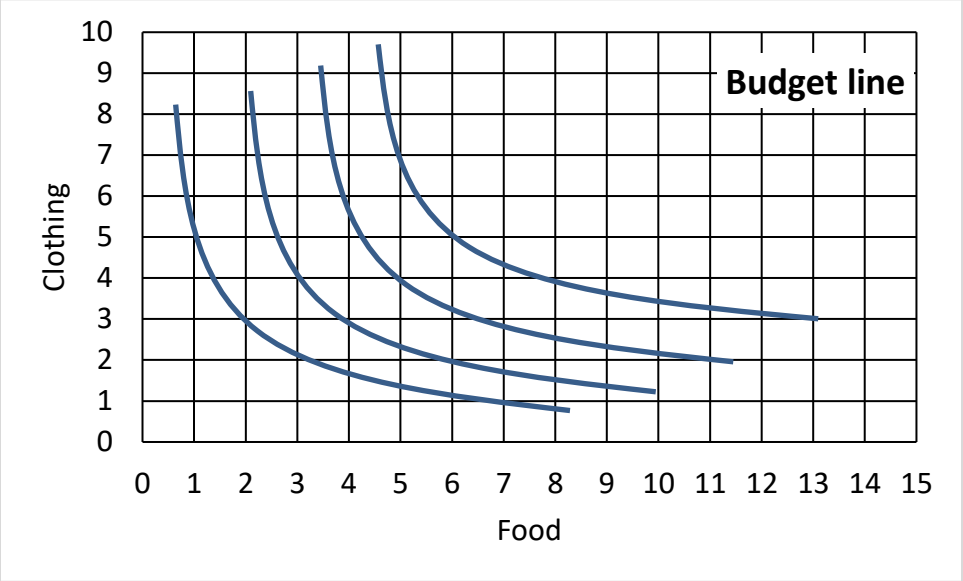
b. What is this **country's** opportunity cost of a unit of clothing? units of food

Assume this country's economy is in competitive equilibrium in all markets and the price of a unit of food is **$10**

c. What must be the price of a unit of clothing? $

Adam is a consumer in this economy. He has an income of **$ 50**.

d. **Using a straightedge,** draw Adam's budget line in the indifference-curve graph below.



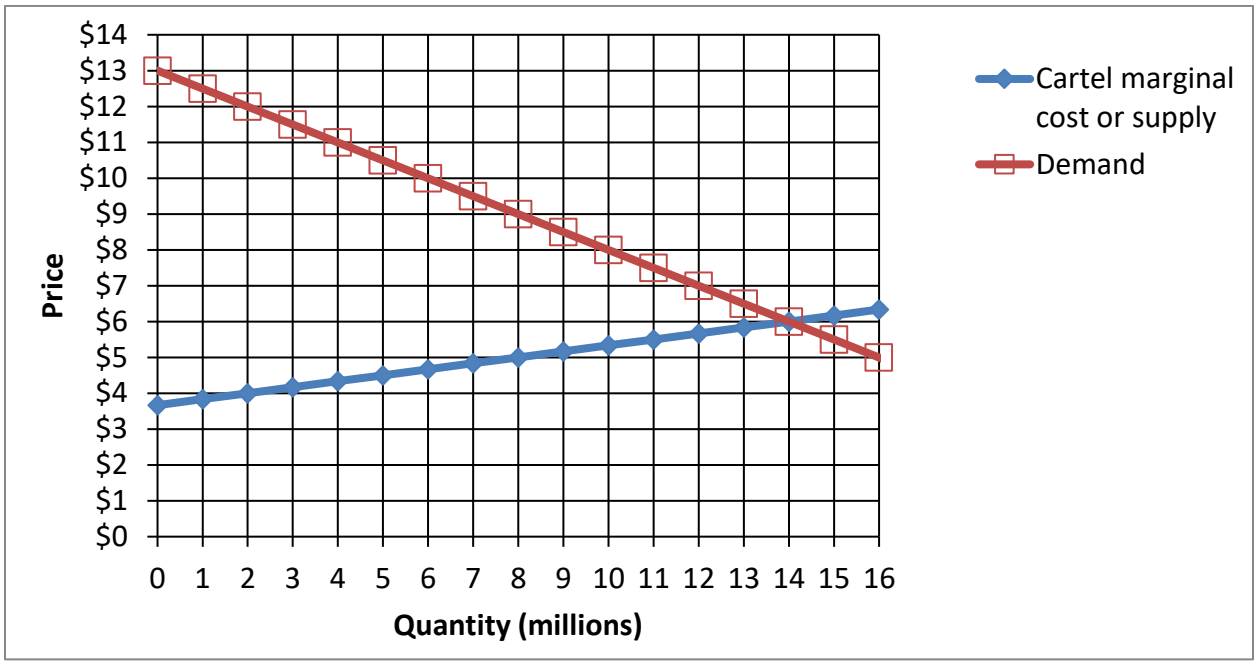
e. What is **Adam's** opportunity cost of a unit of food? units of clothing

f. What is **Adam's** opportunity cost of a unit of clothing? units of food

g. How many units of clothing will Adam choose to purchase? units of clothing

h. At **Adam's** chosen bundle, what is his marginal rate of substitution, that is, the |slope| of his indifference curve at his chosen bundle? (Give a number.)

(10) [Competition versus collusion: 16 pts] Suppose a small group of firms produce vitamins. The graph below shows the demand curve and the joint marginal cost or supply curve of the group of firms.



First, assume the firms *compete* with each other, each maximizing its own profit while taking the market price as given.

a. What will be the equilibrium market quantity?	million
b. If output increased by one more unit at any firm, total costs would increase by how much?	$
c. What will be the equilibrium market price?	$

Second, alternatively assume the firms *collude* with each other, setting price jointly as a cartel to maximize the sum of their profits.

d. *Using a straightedge*, draw and label the colluding firms' marginal revenue curve.

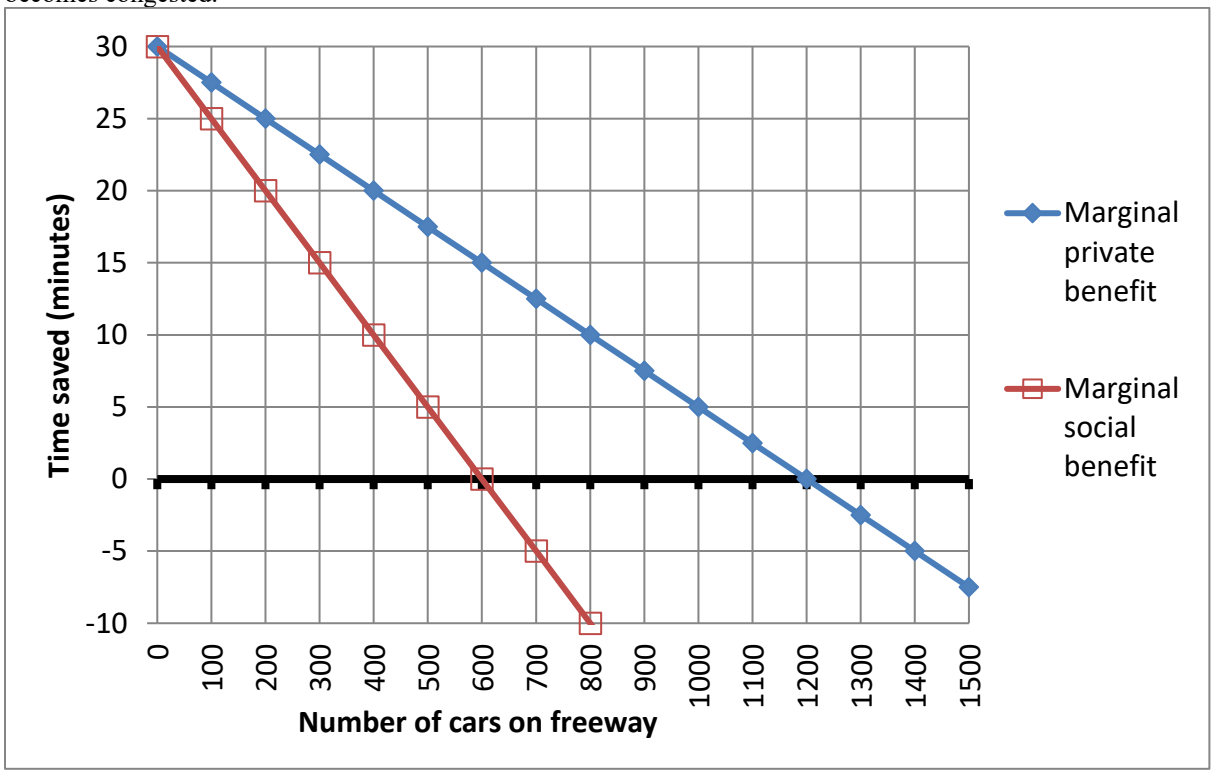
e. What total quantity will the firms produce?	million
f. If output increased by one more unit at any firm, total costs would increase by how much?	$
g. What price will the firms jointly set?	$
h. Compute the social deadweight loss from collusion.	$ million

(11) [Nonrival goods: 6 pts] Suppose 1000 people live near a proposed bike trail. The trail will cost $20,000 per mile to build. Let Q denote the length of the bike trail in miles. A typical individual person's marginal benefit from this bike trail is given by the following expression (or formula): **MB = 40 – 4 Q** .

a. How many miles of bike trail would a typical *individual* pay to build for their own use?
b. Give an expression (or formula) for the marginal social benefit from the bike trail. [Hint: This must be a formula containing one variable: Q.]
c. Compute Q*, the socially-optimal length of the bike trail.

miles
MSB =
miles

(12) [Common property resources: 6 pts] A certain freeway can easily become congested. It is normally the quickest route to downtown, but during rush hour, when one car enters the freeway, all the cars already on the freeway slow down a bit. The graph below shows the average time saved by each car when it enters the freeway ("marginal private benefit"), and the change in total time saved by all cars when another car enters the freeway ("marginal social benefit"). Note that the change in total time saved by all cars turns negative as the freeway becomes congested.

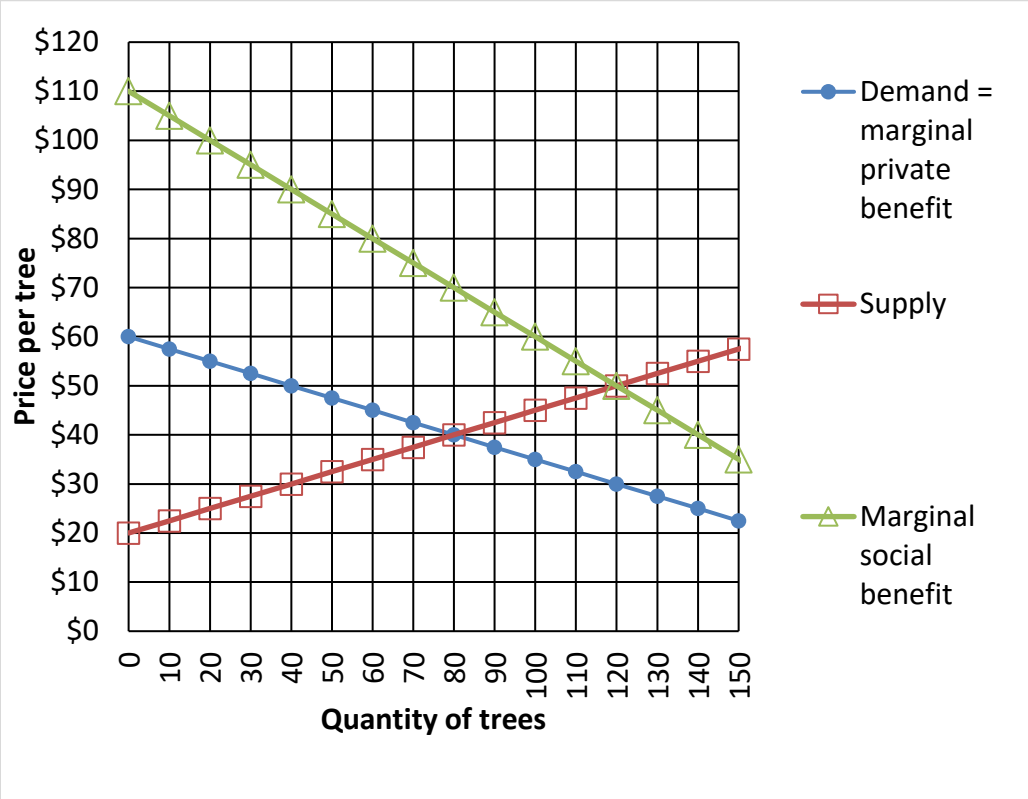


a. How many cars will enter the freeway if entry onto the freeway is unregulated?

b. What is the socially-optimal number of cars on the freeway—that is, the number of cars that maximizes total time saved by all cars on the freeway?
c. Suppose a typical driver is willing to pay $1 for each five minutes saved by entering the freeway. What toll (in dollars) would ensure that the optimal number of cars entered the freeway?

cars
cars
$

(13) [Externalities: 12 pts] The graph below shows the market for trees in a particular city. A tree provides shade for the homeowner who buys and plants one on their property, but also helps reduce summer temperatures in the whole neighborhood and makes the neighborhood more attractive. Therefore, in addition to demand and supply curves, a curve representing marginal social benefit is shown.



a. Compute the (unregulated) competitive equilibrium price.	$ per tree
b. Compute the (unregulated) competitive equilibrium quantity.	trees
c. Compute the economically efficient (or socially optimal) quantity.	trees
d. Compute the deadweight loss from unregulated competition.	$
e. To eliminate this deadweight loss, should the government enact a *tax* or a *subsidy* on trees?	
f. What should be the tax rate or subsidy rate?	$ per tree

(14) [Regulating pollution: 19 pts] Five factories are each producing one unit of pollution per year. The government has determined that total pollution must be reduced to **2** units per year (a reduction of **3** units). The cost of cleaning up pollution at each factory is given below.

Factory	A	B	C	D	E
Annual cost of cleaning up pollution	$15	$35	$25	$45	$5

Command-and-control:

a. To minimize the total cost of cleaning up, which **3** factories should be commanded to clean up? Give their letters.

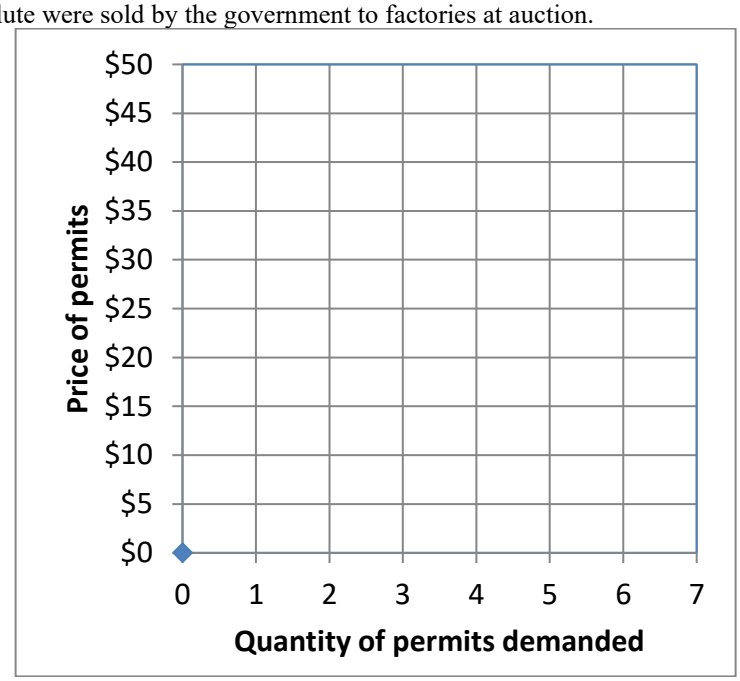
b. What would be the total cost of cleaning up for these **3** factories together?

$

Now suppose the government does not know each factory's cost of cleaning up, so the command-and-control approach is infeasible. Consider the following alternative approaches.

Auction: Suppose **2** permit (or waiver) to pollute were sold by the government to factories at auction.

c. [5 pts] Draw the factories' demand curve for permits in the graph at right. Be sure to draw correct "stairsteps."



In this auction, the price starts at $0 and rises in increments of $10.

d. Which factories would win the permit? Give their letters.

e. What would be the final auction price of a permit to pollute?

f. What would be the total cost of cleaning up for those **3** factories that did not win permits in the auction?

$
$

Pollution fee: Suppose the government imposed a fee for pollution. Factories could either pay the fee or pay the cost of cleaning up.

g. What fee would reduce the amount of pollution to **2** units: $0, $10, $20, $30, $40, $50, or $60?

h. What would be the total cost of cleaning up for those **3** factories that chose not to pay the fee?

$
$

III. Critical thinking: Write a one-paragraph essay answering ***one*** question below (your choice). [4 pts]

(1) Give an example of a government intervention that makes a market *less* efficient. Explain why the intervention decreases economic efficiency and illustrate your argument using a supply-and-demand graph. Label all curves and axes. Shade and label the triangle of deadweight loss *caused* by government intervention.

(2) Give an example of a government intervention that makes a market *more* efficient. Explain why the intervention increases economic efficiency and illustrate your argument using a supply-and-demand graph. Label all curves and axes. Shade and label the triangle of deadweight loss *eliminated* by government intervention.

Please circle the question you are answering. Write your answer below. Full credit requires correct economic reasoning, legible writing, good grammar including complete sentences, and accurate spelling.

[end of exam]